EATON | Cutler-Hammer

Siemens APOGEE™ FLN (P1) Communication Kit

User Manual

February 2006
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February 2006

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The information contained in this manual is subject to change without notice.

Cover Photo: Cutler-Hammer® HVX9000 Drives

Table of Contents

List of Figures

List of Tables

Safety

Definitions and Symbols

⚠ WARNING

This symbol indicates high voltage. It calls your attention to items or operations that could be dangerous to you and other persons operating this equipment. Read the message and follow the instructions carefully.

⚠

This symbol is the "Safety Alert Symbol." It occurs with either of two signal words: CAUTION or WARNING, as described below.

⚠ WARNING

Indicates a potentially hazardous situation which, if not avoided, can result in serious injury or death.

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, can result in minor to moderate injury, or serious damage to the product. The situation described in the CAUTION may, if not avoided, lead to serious results. Important safety measures are described in CAUTION (as well as WARNING).

Hazardous High Voltage

⚠ WARNING

Motor control equipment and electronic controllers are connected to hazardous line voltages. When servicing drives and electronic controllers, there may be exposed components with housings or protrusions at or above line potential. Extreme care should be taken to protect against shock.

Stand on an insulating pad and make it a habit to use only one hand when checking components. Always work with another person in case an emergency occurs. Disconnect power before checking controllers or performing maintenance. Be sure equipment is properly grounded. Wear safety glasses whenever working on electronic controllers or rotating machinery.

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Chapter 1 — Overview

Introduction

The Cutler-Hammer® HVX9000 from Eaton's electrical business can be controlled, monitored and programmed from a host system via the Siemens APOGEE™ FLN (P1) communication protocols with the addition of the OPTCB RS-485 Communication Option Board kit.

If you purchase your Communication Board Kit separate from the drive, please note that it must be installed in slot E on the control board of the HVX9000.

Specifications

Table 1-1: Specifications

Item	Specification
Communication Board Connections	
Interface	OPTCB: Pluggable connector (5.08 mm)
Data Transfer Method	RS-485, half-duplex
Transfer Cable	Twisted pair (1 pair and shield)
Electrical Isolation	500V DC
Communications	
Siemens P1	As described in Siemens P1 Protocol Specification
Baud Rate	4800 baud
Addresses	0 to 99
Environment	
Ambient Operating Temperature	14 to 131°F (-10 to 55°C)
Storage Temperature	-40 to 140°F (-40 to 60°C)
Humidity	<95%, non-condensing
Altitude	Max. 3280 ft. (1000m)
Vibration	0.5G at 9 to 200 Hz
Safety	
Standards	Fulfils EN 50178 standard
Certification	CE, UL

Chapter 2 — Board Layout and Connections

The RS-485 Communication Board is connected to the communications bus through a 5-pin pluggable bus connector (OPTCB board).

Communication with the control board of the drive takes place through the standard interface board connector shown in **Figure 2-1**.

OPTCB Communication Board

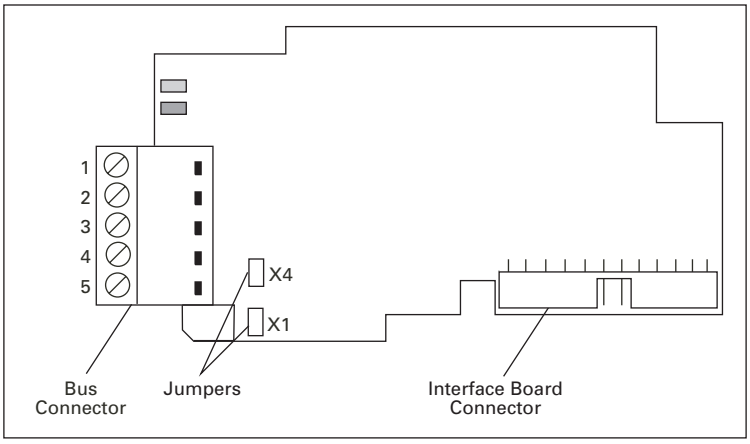
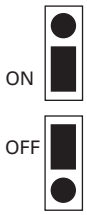


Figure 2-1: OPTCB Communication Board

Table 2-1: OPTCB Bus Connector Signals

Signal	Connector	Description
NC ①	1 ①	No connection
VP	2	Supply voltage – plus (5V)
R_xD/T_xD –N	3	Receive/Transmit data – minus (A)
R_xD/T_xD –P	4	Receive/Transmit data – plus (B)
DGND	5	Data ground (reference potential for VP)

① This pin (1) can be used to bypass the cable shield to the next slave.



Jumper X4 is the 120Ω termination resistor. Set jumper X4 to ON only if the Cutler-Hammer drive is the last device on the network.

Jumper X1 has no effect on OPTCB board.

Chapter 3 — Installation

Making the Ground Connection

Grounding by Clamping the Cable to the Drive Frame

This method of grounding is the most effective, and especially recommended when the distances between the devices are relatively short or if the device is the last device on the network.

Note: Normally, the option board has already been installed in slot E of the control board. It is not necessary to detach the whole board to ground the bus cable shield. Just detach the terminal block.

1. Strip about 2 in. (5 cm) from the cables (shown at the left of **Figure 3-1**), and cut off the gray cable shield.

   Note: Do this for both communication cables, except for the last device.

2. Leave no more than 1/4 in. (1 cm) of each cable outside the terminal block, and strip the ends of both cables (shown at the right of **Figure 3-1**) to about 0.2 in (0.5 cm) to fit in the terminals.

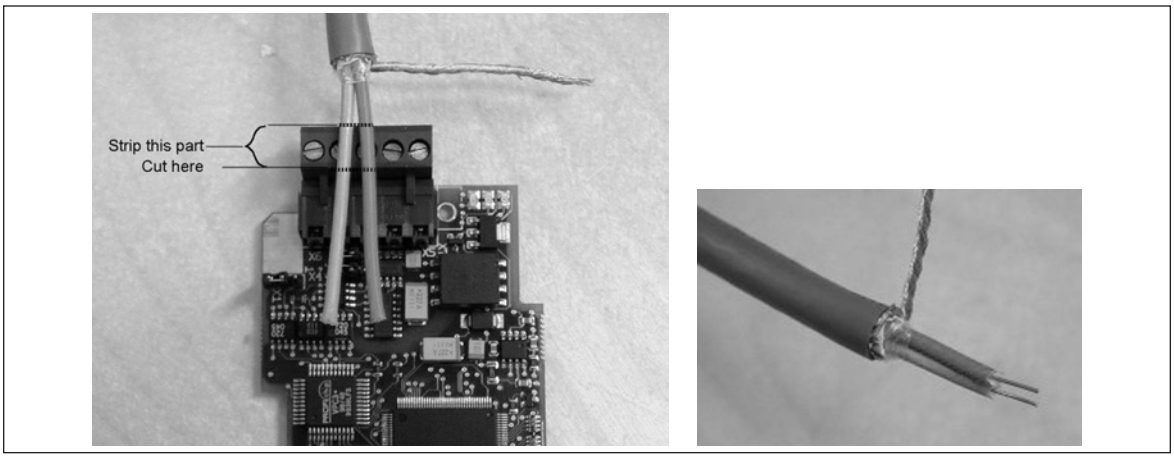


Figure 3-1: Cable Stripping

3. Insert the cables into Terminals 3 (Cable A) and 4 (Cable B). See **Figure 3-2**.

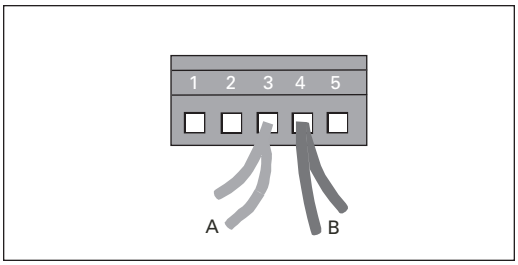


Figure 3-2: Inserting the Data Cables

4. Strip the communication cables so they can be secured to the drive frame with the grounding clamp. See **Figure 3-3**.

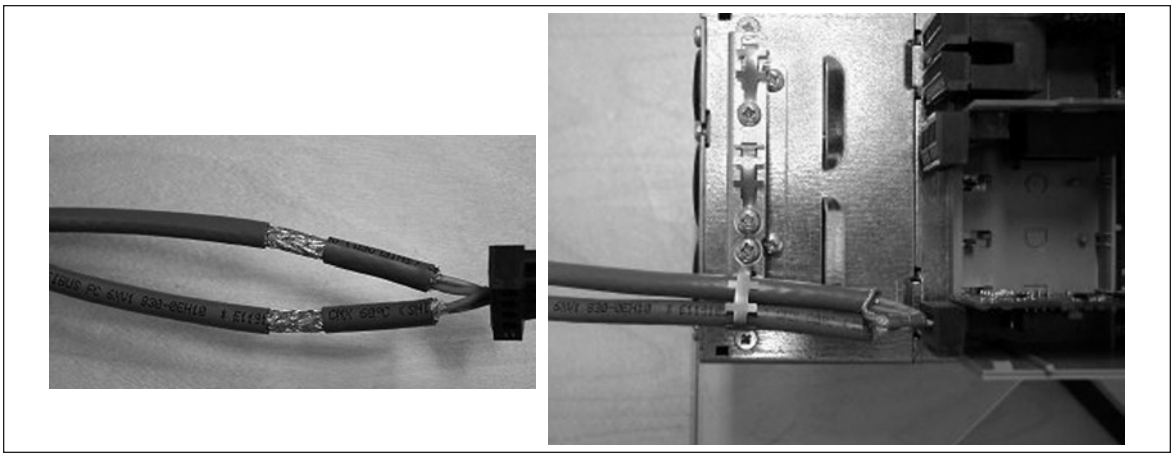


Figure 3-3: Grounding the Communication Cables

Grounding Only One Point on the Net

In this method of grounding, the shield is connected to ground only at the last device on the network. Other devices on the network bypass the shield.

1. Strip about 2 in. (5 cm) from the cables and cut off the gray cable shield.
2. Leave no more than 1/4 in. (1 cm) of each cable outside the terminal block, and strip the ends of both cables to about 0.2 in. (0.5 cm) to fit in the terminals. See **Figure 3-4**.

Note: We recommend that you use an Abico connector to fit the shields into the terminal.

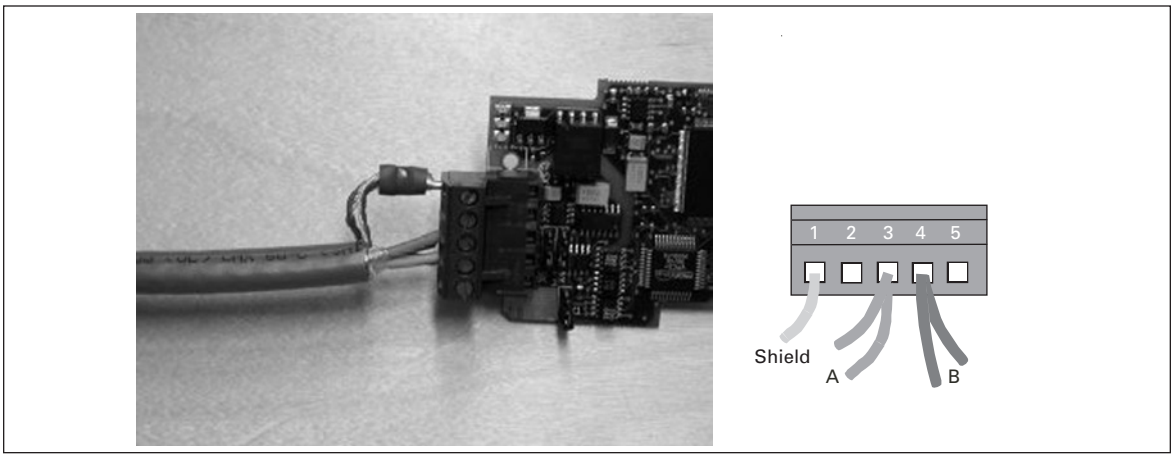


Figure 3-4: Stripping the Communication Cables

3. Secure the communication cables to the drive frame with the grounding clamp as shown in **Figure 3-5**.

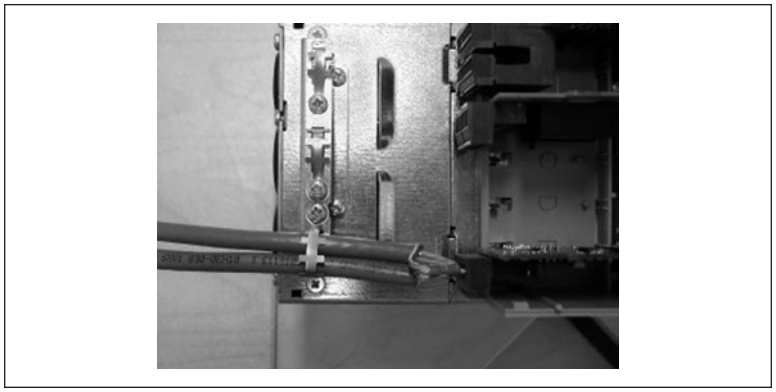


Figure 3-5: Grounding the Communication Cables

Bus Terminal Resistors

If the OPTCB connector is the last device on the network, the bus termination must be set to ON with Jumper X4. See **Figure 3-6**.

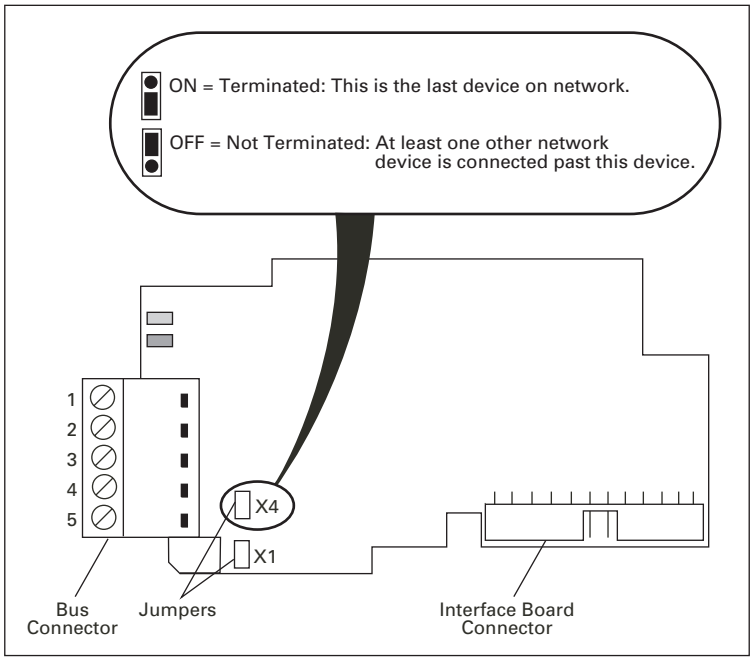


Figure 3-6: Using Jumper X4 to Set the Bus Termination

Bus Biasing

Bus biasing is required to ensure faultless communication between devices at RS-485 bus. Bus biasing makes sure that the bus state has proper potential when no one is transmitting. Without biasing faulty messages can be detected when the bus is in idle state. RS-485 bus state should be from +0.200 to +7V or -0.200 to -7V. Illegal bus state is from -0.200 to 0.200V.

Table 3-1: Bias Resistor Size vs. Number of Nodes

Number of Nodes	Bias Resistance
2 – 5	1.8k ohm
5 – 10	2.7k ohm
11 – 20	12k ohm
21 – 30	18k ohm
31 – 40	27k ohm

Failsafe Biasing in OPTCB Option Board

Connect resistor biasing resistors between PIN 2 – PIN 4 and PIN 3 – PIN 5. See **Figure 3-7**.

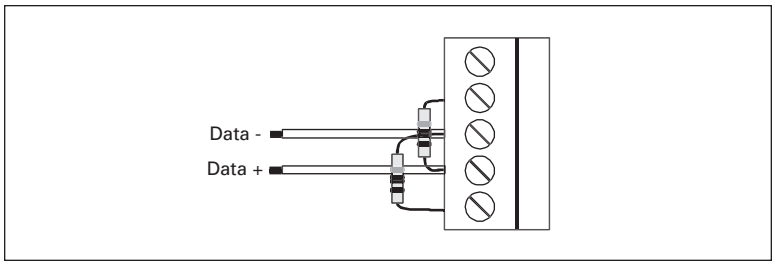


Figure 3-7: Connecting Resistor Biasing

National Semiconductor (www.national.com) has a very good application note, *Failsafe Biasing of Differential Buses* (AN-847.PDF), concerning this problem.

LED Indications

The two LED indicators next to the connector show the present status of the Communication Board (yellow) and the Fieldbus Module (green). See **Figure 3-8**, **Table 3-2** and **Table 3-3**.

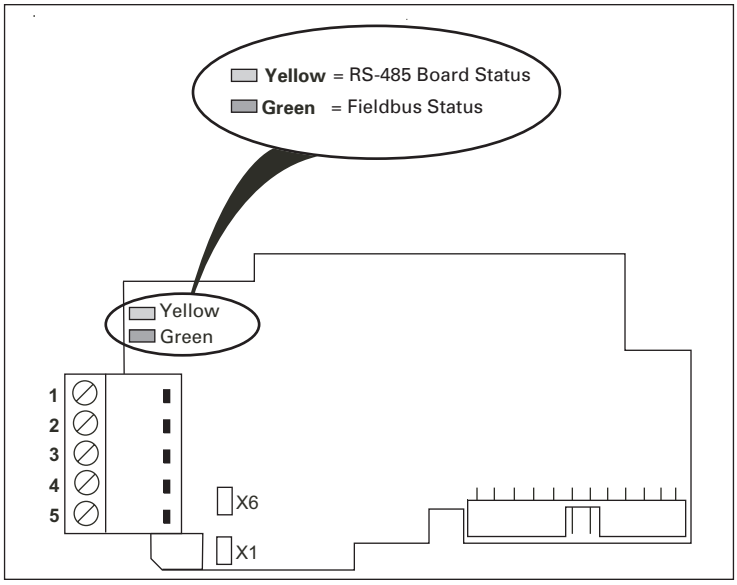


Figure 3-8: LED Indications on the Communication Board

Table 3-2: Communication Board Status LED (BS) — YELLOW

LED is:	Meaning:
OFF	Option board not activated
ON	Option board in initialization state waiting for activation command from the Adjustable Frequency Drive (AFD)
Blinking fast (once/sec)	Option board is activated and in RUN state Option board is ready for external communication
Blinking slow (once/5 secs)	Option board is activated and in FAULT state Internal fault of option board

Table 3-3: Fieldbus Status LED (FS) — GREEN

LED is:	Meaning:
OFF	Fieldbus module is waiting for parameters from the AFD No external communication
ON	Fieldbus module is activated Parameters received and module activated Module is waiting for messages from the bus
Blinking fast (once/sec)	Module is activated and receiving messages from the bus
Blinking slow (once/5 secs)	Module is in FAULT state No messages from Master within the watchdog time Bus broken, cable loose or Master off-line

Installing the OPTCB Communication Board

Table 3-4: Installing the OPTCB Communication Board

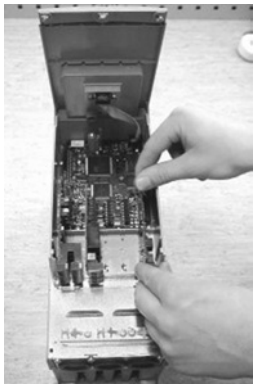
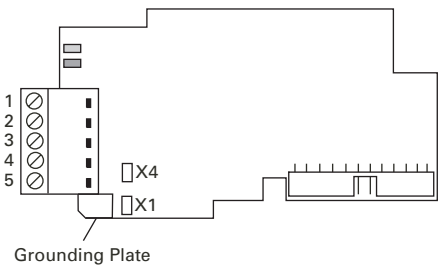
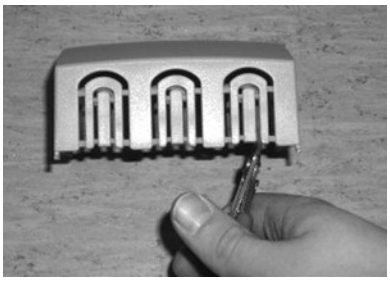
Procedure	Illustration
1. Remove the cable cover.	
2. Open the cover of the control unit.	
3. Install the OPTCB option board in slot E on the control board of the AFD. Make sure that the grounding plate (shown below) fits tightly in the clamp.	 

Table 3-4: Installing the OPTCB Communication Board, continued

Procedure	Illustration
4. Make a sufficiently wide opening for your cable by cutting the cover grid as wide as necessary.	
5. Close the cover of the control unit and the cable cover.	

Chapter 4 — Commissioning

Fieldbus Board Parameters

The RS-485 Communication Board (OPTCB) is commissioned with the control keypad by giving values to appropriate parameters in the Expander board menu M4.

Expander Board Menu (M4)

The Expander board menu makes it possible for the user (1) to see what expander boards are connected to the control board, and (2) to view and edit the parameters associated with the expander board.

Enter the following menu level (**G4**) with the menu button ► (right arrow). At this level, you can browse through slots A to E with the Browser buttons to see which expander boards are installed. On the bottom line of the display, you also see the number of parameter groups associated with the board.

If you press the menu button ► again, you will reach the parameter group level where there are two groups: Editable parameters and Monitored values. Another press on the menu button ► takes you to either of these groups.

Siemens FLN Communication Parameters

To commission the Siemens FLN Communication Board, enter the level P4.5.1.# from the Expander Board Menu 4. The board can be installed in either slot D (G4.4) or slot E (G4.5). It is installed in slot E from the factory.

Table 4-1: Changing the FLN Board Commissioning Parameter Values

#	Name	Default	Range	Description
1	Communication Timeout	10	0 – OFF 1 – 300 s	See ***Communication Timeout*** on **Page 4-2.**

The SLAVE ADDRESS of every device must be set before connecting to the bus. The SLAVE ADDRESS must be the same as in the master configuration. The baud rate is automatically configured for 4800. No adjustment is possible.

1. Review the following drive and fieldbus application parameter settings:
   - Check that application HVX9.11 or later is selected.
     Application Selection S3.2 = HVX9.11 or later version
     Refer to the *HVX9000 User Manual* for instructions on how to set parameters using the keypad.
   - Check that start source auto is set to network. This allows the user to provide start/stop commands from the FLN network.
     Parameter P1.1.17 = Fieldbus
   - Check that reference source auto is set to network. This allows the user to provide a speed reference from the FLN network.
     Parameter P1.1.18 = Fieldbus
   - Check that the HOA mode is set to AUTO.

2. Set the FLN address for the device if desired (default address is 99).
   Parameter P1.13.9 = (1 – 99)

   The drive is set up for FLN network communication.

For more information about the description of some parameters, see the *HVX9000 User Manual*, HVX9.11 or later version.

Communication Timeout

The RS-485 Communication Board initiates a communication error if communication is broken for as long as defined by the Communication Timeout. Communication Timeout is disabled when given a 0 value.

Communication Status

To see the present status of the communication board, enter the Communication status page from the Monitor menu (G7.5.2). See **Figure 4-1** and **Table 4-2**.

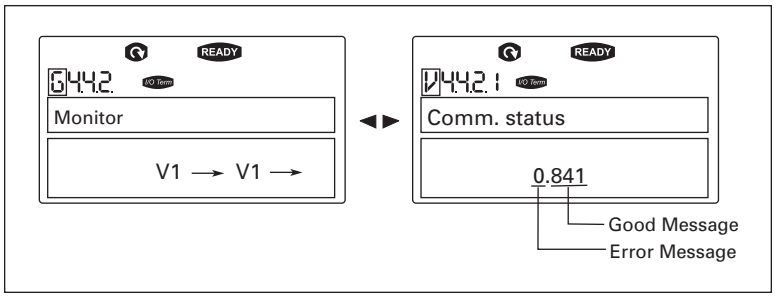


Figure 4-1: Communication Status

Table 4-2: Communication Message Indications

Messages	Indications
Good messages	
0 – 999	Number of messages received without communication errors
Error messages	
0 – 64	Number of messages received with CRC or parity errors

Chapter 5 — Siemens FLN (P1) Protocol

Overview

The P1 Protocol provides:

- Direct control of Drive (e.g. Run, Stop, Direction, Speed reference, Fault reset)
- Full access to necessary parameters
- Monitoring of Drive status (e.g. Output frequency, Output current, Fault code)

P1 Point Map

Analog Input (AI) Point Map

Table 5-1: Analog Inputs (AI)

NPT	Point Number	Description	Units
AI	3	FREQ OUTPUT	Hz
AI	4	PCT OUTPUT	%
AI	5	SPEED	rpm
AI	6	CURRENT	A
AI	7	TORQUE	%
AI	8	POWER	%
AI	9	DRIVE TEMP	° F (° C)
AI	10	DRIVE KWH	kWh
AI	11	DRIVE MWH	MWh
AI	12	RUN TIME	Hours
AI	13	DC BUS VOLT	V
AI	14	MOTOR VOLT	V
AI	43	DRV ACT AO 1	mA
AI	45	DRV ACT AI 1	V
AI	46	DRV ACT AI 2	mA
AI	60	PID FEEDBACK	%
AI	65	PID ERROR	%
AI	70	DIN STATUS	—
AI	71	RO STATUS	—
AI	90	LAST FAULT	—
AI	91	PREV FAULT	—

Analog Output (AO) Point Map

Table 5-2: Analog Outputs (AO)

NPT	Point Number	Description	Units
AO	1	CTLR ADDRESS	—
AO	2	APPLICATION	—
AO	20	OVRD TIME	Hours
AO	30	CURRENT LIM	%
AO	31	ACCEL TIME 1	Seconds
AO	32	DECEL TIME 1	Seconds
AO	48	CMD DRV AO1	%
AO	51	SPEED REF	%
AO	52	PID SETPOINT	%
AO	61	PID GAIN	%
AO	62	PID I TIME	Seconds
AO	63	PID D TIME	Seconds
AO	99	ERROR STATUS	—

Binary Input (BI) Point Map

Table 5-3: Binary Inputs (BI)

NPT	Point Number	Description	0 =	1 =
BI	21	FWD / REV	Forward	Reverse
BI	23	STOP / RUN	Stop	Run
BI	25	DRIVE READY	Not Ready	Ready
BI	35	INTERLOCK	Yes	No
BI	49	AT SPEED	No	Yes
BI	81	BYPASS ACT	Off	On
BI	93	OK / FAULT	OK	Fault

Binary Output (BO) Point Map

Table 5-4: Binary Outputs (BO)

NPT	Point Number	Description	0 =	1 =
BO	18	RST KWH-MWH	No	Reset
BO	19	RST Run Time	No	Reset
BO	22	CMD FWD / REV	Forward	Reverse
BO	24	CMD STP / STRT	Stop	Start
BO	29	DAY / NIGHT	Day	Night
BO	33	LOCK PANEL	Open	Lock
BO	36	CMD DIN 3	Off	On
BO	37	CMD DIN 4	Off	On
BO	38	CMD DIN 5	Off	On
BO	39	CMD DIN 6	Off	On
BO	40	CMD DRV RO 1	Off	On
BO	41	CMD DRV RO 2	Off	On
BO	42	CMD DRV DO 1	Off	On
BO	80	CMD BYPASS	Disable	Enable
BO	94	RESET FAULT	No	Reset

Chapter 6 — Communication Board Fault Tracking

The table below presents the faults related to the Siemens FLN (P1) option board. For more fault code information, see also *HVX9000 User Manual*, Fault Tracking Section.

Table 6-1: Communication Board Faults

Fault Code	Fault	Possible cause	Possible solutions
37	Device change	Option board changed	Reset
38	Device added	Option board added	Reset
39	Device removed	Option board removed	Reset
40	Device unknown	Unknown option board	Check the installation. If installation is correct contact the nearest Eaton distributor.
53	Communication bus fault	The data connection between the communication bus master and the communication bus board has failed.	Check the installation. If installation is correct contact the nearest Eaton distributor.
54	Slot fault	Defective option board or slot	Check that the board is properly installed and seated in slot. If installation is correct, contact the nearest Eaton distributor.

You can define with parameters how the AFD shall react to certain faults:

Table 6-2: AFD Response to Faults

Code	Parameter	Min.	Max	Unit	Step	Default	Note
P1.7.22	Response to fieldbus fault	0	3		1	2	0=No response 1=Warning 2=Fault, stop acc. to 2.4.7 3=Fault, stop by coasting
P1.7.23	Response to slot fault	0	3		1	2	0=No response 1=Warning 2=Fault, stop acc. to 2.4.7 3=Fault, stop by coasting

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